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FEB 4 1985

National Marine Fisheries Service
2570 Dole Street
Honolulu, Hawaii

SOUTHWEST FISHERIES CENTER

MONTHLY REPORT - NOVEMBER 1984

PUBLICATIONS	1
HONOLULU LABORATORY	3
Yellowfin Tuna Successfully Tracked for Eight Hours.	4
COASTAL FISHERIES RESOURCES DIVISION	7
Analysis of Relation Between Fat Concentration in Female Anchovy and Batch Fecundity	9
OCEANIC FISHERIES RESOURCES DIVISION	14
Scientist Investigates Large-Scale Spatial-Temporal Patterns in Distribution of Dolphins.	16
Study Shows That Swimming Helps Dolphins Stay Warm	20
PACIFIC ENVIRONMENTAL GROUP	23
Researchers Note General, Long-Term Warming of Coastal Waters	23
TIBURON LABORATORY	25
Studies Determine Krill Abundance off Central California	26
FISHERIES INFORMATION SYSTEMS & ADP	29
Pacific Islands Fishery Officials Visit WPACFIN Office	30
ADMINISTRATIVE ACTIVITIES	31
MISCELLANEOUS	32
Honors, Awards, Seminars, Public Affairs, Visitors, Meetings and Travel, and Personnel	32



SOUTHWEST FISHERIES CENTER

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SOUTHWEST FISHERIES CENTER

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Status of Publications

Published

Alvariño, Angeles. 1983. The depth distribution, relative abundance and structure of the population of the Chaetognatha Sagitta scrippsae Alvariño 1962, in the California Current off California and Baja California. An. Inst. Cienc. Del Mar Y Limnol. Univ. Nal. Autón, México, 10(1): 47-84.

Sagitta scrippsae is an inhabitant of the Transition region of the North Pacific, occurring between 25 m and 475 m depth (but occasionally deeper) off California and Baja California. It is abundant in the strata between 100 and 350 m, decreasing gradually in numbers and area occupied above and below those layers.

The collections analyzed in this paper were obtained in 1969 off California and Baja California, from day and night hauls at identical locations and depth strata (0-25, 25-50, 50-75, 75-100, 100-225, 225-350, 350-475, 475-600 m depth) on winter (February-March), spring (May-June), summer (August-September), and fall (November-December) cruises.

The greatest number of specimens was collected on the August-September cruise; the number was about twice that of November-December cruise, and three times that of the spring (May-June) cruise. The lowest number occurred in winter (February-March).

Sagitta scrippsae occurred off California and Baja California in waters deeper and farthest west and south in August-September than during any other season of 1969. It was present in the 25-0 m stratum only in February-March 1969.

Sagitta scrippsae was most abundant on the northern Line of Stations in each season, and less abundant or absent on the southernmost Lines. This distributional pattern indicates the source of the California population of S. scrippsae is in the waters north of California.

Present data indicate that S. scrippsae breeds in every season, with a peak in the summer and a low in winter. The life history of the species is analyzed, and the four stages of maturity are described. Size ranges of each stage are indicated, together with day and night distribution with respect to depth, location and season. Fluctuations in the size range of fully mature individuals are discussed.

The distribution of S. scrippsae off California and Baja California shows a positive correlation with the intensity of the California Current, gradually decreasing in numbers as the California Current loses its distinctiveness. Therefore, the species could be used as

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an indicator of the northern flow off California and Baja California to identify the farthest extent of these waters from the north, and to estimate the degree of mixing taking place in the California Current System. Evidence is outlined on the distribution of this chaetognath and the characteristics of some endemic and seasonal fisheries in this region.

Grigg, R.W., J.J. Polovina, and M.J. Atkinson. 1984. Model of a coral reef ecosystem. III. Resource limitation, community regulation, fisheries yield and resources management. *Coral Reefs* 3(1):23-27.

The results of modeling of a coral reef ecosystem at French Frigate Shoals and independent field measures of benthic primary productivity indicate relatively good agreement between food required by consumer trophic levels and organic carbon produced by primary producers. Based upon the high internal predation necessary for the model to match primary production estimates, we reason that the ecosystem is primarily regulated from the top down by forces of predation and that primary production appears to be controlled by nutrients, rate limits, and the distribution of space and habitat. In spite of relatively high primary productivity, potential yield at the top of the food chain is low because of high internal predation and high trophic complexity (6 trophic levels). Fishery yield might be maximized by harvesting low on the food chain particularly if top carnivores can be cropped to release predator pressure on selected prey. Agreement between field measures of metabolism and model (ECOPATH) results provides reasonable confidence that the model can be used as one tool for resource management.

Approved by Center Director

Hobson, Edmund S. Predation on the Pacific sand lance, Ammodytes hexapterus, during the transition between day and night in southeastern Alaska. For consideration for publication in *Copeia*.

Prescott, J.H. Size at maturity in the Hawaiian spiny lobster (Panulirus marginatus), at Oahu and Necker Islands. *Can. J. Fish. Aquat. Sci.*

Ralston, S. An intensive fishing experiment for the caridean shrimp Heterocarpus laevis at Alamagan Island in the Mariana Archipelago. *Can. J. Fish. Aquat. Sci.*

Wetherall, J.A., and M.Y.Y. Yong. Estimating parameters of maturation and allometry. *Can. J. Fish. Aquat. Sci.*

Administrative Report

Johanos, T.C. Hawaiian monk seal association patterns on Lisianski Island: 1982 pilot study. Southwest Fish. Cent. Honolulu Lab., Natl. Mar. Fish. Serv., NOAA, Admin. Rep. H-84-18.

HONOLULU LABORATORY

Honolulu, Hawaii

Insular Resources Investigation

Thermal Shock Experiments on Tropical Marine Fishes Continue

Research assistant Yara Lamadrid-Rose and Thomas K. Kazama, Fishery Biologist, continued experiments to assess the effects of cold thermal shock on tropical marine fishes. These experiments are associated with projects for proposed ocean thermal energy conversion development. In November, the first studies on juvenile fish were carried out. Juvenile mullet, Mugil cephalus, collected at a local beach, were used in a complete series of experiments. The juveniles were exposed to cold shocks of 5°, 10°, and 15°C below ambient, each with three replicates (and controls) at 8-, 16-, and 24-minute exposure times. The fish exposed to changes of 5°, and 10°C displayed various degrees of subdued behavior, although there was no mortality at either temperature change. The fish exposed to changes of 15°C, however, went into immediate shock; mortalities averaged 50% at the three exposure times.

Bottom Longline Tested as Sampling Gear

A modified version of the "kali" bottom longline gear for bottom fish used in the Caribbean was developed earlier in the fall and was successfully tested on Leg I of Townsend Cromwell cruise TC-84-06 in the Northwestern Hawaiian Islands (NWHI). Paul M. Shiota, Fishery Biologist, who served as Chief Scientist on this leg of the cruise, reports that a total of 1,568 kg of bottom fishes was landed on 5,165 hooks fished for a catch rate of 6.8 fish per 100 hooks. Pink opakapaka, Pristipomoides filamentosus, butaguchi, Pseudocaranx dentex, and hapuupuu, Epinephelis quernus, made up 94% of the catch by weight and 87% of the catch by number. The catch rate obtained compares favorably with that obtained by handlining, the technique currently used to assess the abundance and distribution of these species. These results are encouraging because the gear may allow greater fishing effort per research vessel day. Further tests have been planned for future cruises, including direct comparisons with handline gear.

Fishery Management Research Program

Spiny Lobster Carapace Length-Tail Width Relations to Be Examined

At the request of the Western Pacific Program Office of the Southwest Region researchers of the Fishery Management Research Program (FMRP) will compute carapace length-tail width relationships and examine the relationships between fecundity and tail width rather than carapace length,

which was used in determining the existing minimum carapace length regulation.

Dr. Robert A. Skillman, Leader of FMRP and Joan P. Draper, Computer Programmer, calculated functional regressions for spiny lobster fecundity data. Research assistant Victor A. Honda calculated a fecundity relationship using number of eggs and carapace length. Approximately half of the data used by Honda also had associated tail width measurement data, and these were used to compute the relationship between the number of eggs and tail width as well as carapace length. The carapace length measurements will also be converted to tail width measurements, using relationships which will be calculated later, and then compared with the fitted fecundity relationships described above.

The relationship between carapace length and at least two tail width measurements will be computed using functional regressions. The data needed for the computation of the relationship were collected on a cruise in October of the NOAA Ship Townsend Cromwell.

* * * * *

Skillman reports that data collected on spiny lobster escape vent experiments during two recent cruises of the Townsend Cromwell will be analyzed for a report to be presented at the Western Pacific Regional Fishery Management Council meeting on Kauai.

* * * * *

Victor Honda completed drafts of two papers, one describing the Hawaiian tuna longline fishery and one on the fecundity of spiny lobsters in the NWHI.

* * * * *

At the request of the Director's Office, Skillman and Samuel G. Pooley, Industry Economist, reviewed a draft report prepared by the staff of the Hawaii Department of Planning and Economic Development which assesses the impact of tuna purse seine landings on the Hawaii economy. The report presents an optimistic picture, but neglects some negative effects according to Skillman and Pooley.

Pelagic Resources Investigation

Yellowfin Tuna Successfully Tracked for Eight Hours

Lt. (jg) Jeffrey A. Koch, NOAA Corps, Dr. Kim Holland, Hawaii Institute of Marine Biology, University of Hawaii, and Randolph K.C. Chang, Fishery Biologist, tracked an approximately 60 cm long yellowfin tuna, Thunnus albacares, tagged near one of the fish aggregating devices located off the Waianae coast of Oahu, Hawaii. It remained in the vicinity of the

off the Waianae coast of Oahu, Hawaii. It remained in the vicinity of the device for a few hours, and then moved north. The fish was lost after 8 hours because it had swum to the windward side of Kaena Point where the sea conditions were choppy. Two days were spent searching around the three devices located off the Waianae coast and the 91 m (50 fathom) isobath, but the fish was not relocated.

Manuscript on Effects of Temperature Change
on Acid-Base Regulation in Tuna Blood
Accepted for Publication

A manuscript, "Effects of temperature change on acid-base regulation in skipjack tuna (*Katsuwonus pelamis*) blood," by S.F. Perry, C. Daxboeck, B. Emmet, P.W. Hochachka, and R. W. Brill has been accepted for publication by Comparative Biochemistry and Physiology. The work is part of a larger study on acid-base regulation, recovery from strenuous exercise, and effects of low ambient oxygen on tuna. The ultimate goal of this research is the determination of the effect of environment on natural mortality, distribution, energetics, growth rates, and specific vulnerability of tunas to gear.

The manuscript describes the effects of temperature change in vitro on acid-base balance of the blood of tunas. By examining the relationship between blood pH and temperature in vitro under conditions of constant CO₂ tension (open system), it was observed that the rate of change in blood pH with temperature was well within the range of in vitro values reported for other ectothermic vertebrates, and was only slightly different from values obtained in vitro under conditions of constant CO₂ content. The authors concluded that the changes in skipjack tuna blood pH following temperature change can be accounted for solely by the passive, in vitro behavior of a unique chemical buffer system found in skipjack tuna blood. Therefore, the slow, active blood pH regulatory mechanisms of other teleosts need not be postulated for skipjack tuna. This rapid, passive regulation of blood pH with temperature is required by tunas because of the regular 10°-15°C temperature change to which they are subjected during the rapid vertical movements that are a regular part of their behavior in the open ocean.

A second (revised) manuscript, "Effects of exhausting exercise on the acid-base regulation in skipjack tuna (*Katsuwonus pelamis*) blood," by the same authors, has been tentatively accepted by Physiological Zoology.

Manuscript Submitted for Publication

Dr. Richard Brill, Leader, Tuna Behavior and Physiology Task, completed and submitted a manuscript for publication, "The standard metabolic rate of tunas: Effect of body size and acute temperature change," to Physiological Zoology. In this paper Brill describes the effect of body size on the standard metabolic rate (SMR)--the metabolic rate at zero overt muscular activity of yellowfin tuna and kawakawa, *Euthynnus affinis*, as well as the effect of acute temperature change on the SMR of these two species and skipjack tuna, *Katsuwonus pelamis*. He shows that tunas have exceptionally high SMR's even when comparisons are made with other active teleosts of the same body size and at the same water temperatures. Tunas can also achieve

exceptionally high maximum aerobic metabolic rates. This ability is a result of tunas' large gill surface areas, high hematocrits, and high cardiac outputs. These characteristics, in turn, cause tunas to have exceptionally high cardiac and osmoregulatory energy costs. Brill postulates that tunas' high SMR's are an inevitable consequence of their abilities to achieve exceptionally high aerobic metabolic rates.

Tuna Filming Begun at Kewalo Research Facility

Paul Atkins and Mike DeGray of Moana Productions have begun filming swimming and feeding behavior of captive tunas at the Kewalo Research Facility. This film footage will be part of a natural history series produced by the British Broadcasting Company and will be intercut with film footage of wild tunas around Fish Aggregating Devices.

Marine Mammal and Endangered Species Program

Marine Debris Workshop Held in Honolulu

Chaired by Richard Shomura, Director, Honolulu Laboratory, a workshop on "Fate and Impact of Marine Debris" sponsored by the U.S. Fish and Wildlife Service, Marine Mammal Commission, National Marine Fisheries Service, North Pacific Fishery Management Council, Pacific Fishery Management Council, Pacific Sea Grant College Programs, and Western Pacific Fishery Management Council, was held from 26-29 November at the Ala Moana Americana Hotel in Honolulu. The objectives of the workshop were to (1) review the state of knowledge on the fate and impact of marine debris to determine the extent of the problem, (2) identify and make recommendations on possible mitigating actions, and (3) identify and make recommendations on future research needs. Over 125 scientists and other interested individuals from several different countries attended the workshop. The workshop was divided into several sections, including sessions on marine debris, impacts of debris on resources, the fate of marine debris, working group meetings, and a concluding plenary session.

From the Honolulu Laboratory, George H. Balazs, Wildlife Biologist, presented a paper on "Impact of ocean debris on marine turtles: Entanglement and ingestion"; John R. Henderson, Fishery Biologist, presented "A review of Hawaiian monk seal entanglements in marine debris"; Tim Gerrodette, Fishery Biologist, presented "Toward a population dynamics of marine debris"; and Richard N. Uchida, Acting Chief, Pelagic Resources Investigation, discussed "Net fisheries of the North Pacific." Approximately 30 papers were presented at the workshop.

Shomura chaired the steering group which planned the workshop. Other members of the group included: Jim Branson, North Pacific Fishery Management Council; Dr. Douglas G. Chapman, Marine Mammal Commission; Dr. Jack R. Davidson, Sea Grant College Program, University of Hawaii; Dr. Charles Fowler, National Marine Fisheries Service; and Frederick Wathne, Northwest and Alaska Fisheries Center.

COASTAL FISHERIES RESOURCES DIVISION

La Jolla, California

International Meeting on Sardine and Anchovy Recruitment Held in La Jolla

The Sardine and Anchovy Recruitment Project (SARP) meeting was held from November 5 through 9, 1984, at the Southwest Fisheries Center in La Jolla. Representatives from Mexico, Peru, Chile, Argentina, Brazil, Spain, Portugal, the United States, South Africa, Canada, and Sweden gathered to initiate projects on the recruitment of sardines and anchovies in Peru, Chile, and the United States. Most of these countries have an active sardine and/or anchovy fishery and are interested in studying recruitment processes of these fish. Funds for the Meeting were provided under the Ocean Science in Relation to Living Resources (OSLR) initiative and with additional support from the Intergovernmental Oceanographic Commission (IOC). Dr. Reuben Lasker convened and chaired the meeting.

The workshop consisted of two days of presentations by SWFC scientists followed by three days of proposal preparation. Interspersed throughout the week were demonstrations of new techniques developed by SWFC scientists. These techniques will be important in the prosecution of SARP investigations. Among these was a thorough briefing on the egg production method for biomass assessment devised by the Coastal Division.

The meeting resulted in the preparation of three full-scale proposals for work on recruitment on sardines off Chile-Peru and Peru-Ecuador, and for anchovies off U.S.-Mexico. Each proposal included a significant physical oceanography component and attempted to address the problem of how physical measurements could be incorporated into SARP investigations, i.e., to address the question of how the environment affects survival and mortality of larval anchovies and sardines.

A unanimous recommendation of the meeting was that a SARP Coordinating group be formed to monitor and coordinate SARP activities, to communicate with OSLR/IOC, and to promote international and interdisciplinary training and communications. The IOC will consider this recommendation for action in their February 1985 meeting.

While full-scale proposals were not developed at this workshop for Argentina, Brazil, Spain and Portugal, a working group was set up to address the interests of these countries in SARP research. Some of these countries have well-developed programs and infrastructures which are capable of, and in some cases have already undertaken, significant SARP-related work well ahead of the schedules envisioned in IREP. This working group suggested that a pilot program on one tropical clupeoid stock be initiated soon; the Brazilian Sardinella stock is a likely candidate.

It was generally agreed that the SWFC would be the focal point for training of the newer techniques now available, particularly the egg

production method for biomass assessment, the otolith technique for ageing larvae and juveniles, and the historical methods for assessing starvation in larvae. Sea-going techniques would also be taught after a similar SARP program is started in U.S. waters. To encourage international cooperation and standardization among countries, the SWFC agreed that scientists from SARP nations should participate in the U.S. cruises scheduled for 1985 and 1986. Each foreign participant of this SARP workshop was provided with a copy of the completed version of an SWFC Administrative Report, "An egg production method for estimating spawning biomass of pelagic fish: application to the northern anchovy (*Engraulis mordax*).\" It is essentially a text and manual of how the technique can be applied to other species. IOC has agreed to publish it in its entirety.



Participants in the Sardine/Anchovy Recruitment Project Meeting (from left to right): Ronald Lynn, SWFC; Angeles Alvarino, SWFC; Alex Herman, Canada; Robert Owen, SWFC; H. Geoffrey Moser, SWFC; Patricio Bernal, Chile; Richard Barber, Duke Univ.; Gail Theilacker, SWFC; Paul E. Smith, SWFC; Richard Parrish, SWFC; Armando Fiuza, Portugal; Nancy Lo, SWFC; Peter Shelton, South Africa; Richard Methot, SWFC; Clelia Booman, Argentina; Andrew Bakun, SWFC; Martin Hall, Argentina; Alec MacCall, SWFC; Patti Schmitt, SWFC; Blanca Rojas de Mendiola, Peru; Andrew Bindman, SWFC; Carmela Porteiro, Spain; Robert Pedrick, Washington NMFS; Andrew Menz, Ecuador; Mayola Espinosa, Mexico; Rodolfo Serra, Chile; Jorge Csirke, FAO; John Butler, SWFC; Gary Shaffer, Sweden; John Hunter, SWFC; Haydee Santander, Peru; Pablo Arenas, Mexico; Sonia Guarda, Univ. Wash.; Romulo Jordan, CPPS; Yasunobu Matsuura, Brazil; Carlos Lasta, Argentina; Jurgen Alheit, Peru; Beverly Macewicz, SWFC; Reuben Lasker, SWFC.

Coastal Eastern Pacific Population Biology of Fishes

Peruvian Fishery Biologist Completes Six Month Study at Center on Age Determination of Larval Fishes

Fishery biologist Blanca Rojas de Mendiola has returned to IMARPE in Lima, Peru after six months of study and training at the Southwest

Fisheries Center in La Jolla, California in the techniques for age determination in larval fishes. Under the tutelage of biologist John Butler, de Mendiola completed a study of the growth of sardine larvae off Peru and presented the results of this study at the annual CalCOFI meeting in October.

In conducting this study, de Mendiola counted daily increments in the otoliths, using both light microscopy and scanning electron microscopy which revealed large distinct increments (Figure 1). She determined growth rate of larval sardines by plotting the length at age, assuming that the first increment is formed on day five as in the anchovy (Figure 2).



Figure 1. Scanning electron micrograph of 14.8 mm sardine larvae.

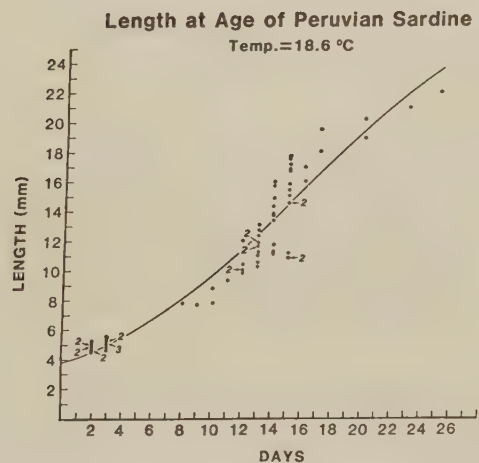


Figure 2. Length at age of Peruvian sardine larvae.

Butler and de Mendiola fit the data with three nonlinear regression equations, using Gompertz, Richards and logistic models, with the logistic equation giving the best fit with the highest degree of freedom. Butler will continue this research investigating the timing of the first increment formation, using California sardines reared in the Center's experimental sea water aquarium.

Analysis of Relation Between Fat Concentration in Female Anchovy and Batch Fecundity

John Hunter and Carol Kimbrell have completed an analysis of the relation between batch fecundity and fat content in northern anchovy. The best evidence for the effect of fat concentration on batch fecundity was provided by stepwise multiple regression. The independent variables used were: X, the dry weight of the female which included 7% fat (the 7% was the minimum fat content observed in females and was considered to approximate the concentration of structural fat); and Y, the amount of

storage fat in grams, which was the total weight of fat in the females less the 7% which was assumed to be structural fat. The dependent variable (Y) was batch fecundity (data from counts of hydrated eggs and modal analysis of egg size frequency distributions).

The final multiple regression equation was:

$$Y = -2481 + 3233X + 3084 Z,$$

where $r^2 = 78.02$ and T-RATIO for the storage fat = 3.749 (n=134). Although inclusion of storage fat as a variable in the multiple regression equation only increased r^2 from 74.9 to 78.0%, partitioning dry weight into structural and energy store fractions demonstrated that fat stores have an effect independent of fish size since the variable made a significant contribution to the multiple regression equation. If storage fat weight were only correlated with female weight, energy stores would not have made a significant contribution to the regression. This effect was not large; a doubling of fat concentration from 15 to 30% of the total dry weight of the fish (including fat) increased the fecundity of a 3.7515 g female (fat free dry weight) by only 24% (11,758 to 14,615 eggs). This increase in fat concentration is equivalent to a 3.4 fold increase in the weight of fat stores in the fish. In the multiple regression model the fecundity rate that increased with fat stores was nearly the same as the rate it increased with fish dry weight because the regression coefficients for these two parameters are nearly the same. Since fat stores are a relatively small fraction of the total dry weight of the fish, the effect of this variable was relatively small.

From the practical standpoint, total fish dry weight (including all fat) is as precise a predictor of batch fecundity as the multiple regression model. The regression of batch fecundity on total dry weight (D) was:

$$Y = -2414 + 3199 D$$

where $r^2 = 77.6\%$. The importance of the multiple regression model is that the grams of fat the fish contained had an effect independent of fish weight indicating that fat stores increase fecundity. An important implication of these results is that an annual cycle in batch fecundity may exist which is linked to the annual fat cycle with fecundity being somewhat higher early in the season and declining as the season progresses.

Commercial and Recreational Fisheries Research for Management

Recreational Fisheries Economics Developments Study Nears Completion

The on-going study of Pacific Coast saltwater recreational fishing, based upon NMFS's Marine Recreational Fishing Statistical Survey data, is progressing toward completion, according to Dr. Robert Rowe, Principal Investigator for Energy and Resource Consultants, Inc. Travel-cost type recreational demand equations have been estimated for the southern California portion of the 1979, 1980, and 1981 data. As of mid-November, separate data files for central California, northern California, Oregon,

and Washington had been established, and preliminary examination of data and demand relationships was begun. Preparation and pre-testing of a new survey instrument for the San Francisco Bay and Ocean area were largely completed during November. To complete the contract work, ERCO needs only to make minor adjustments and final wording changes to the questionnaire.

Cynthia Thomson and Dr. Sam Herrick, Industry Economists, prepared a revised survey instrument and completed the required documents required to obtain OMB approval. These were submitted through Dr. Mark Holliday, of the office of Data and Information Management, Washington, DC.

Thomson is also developing a research proposal showing how the household production model can be used to value welfare changes associated with changes in recreational catch and to obtain a shadow price for household time used in the production and consumption of recreation. This proposal, which is almost completed, will provide a blueprint for analyzing the San Francisco Bay and Ocean area survey data.

New Design for Micronekton Net

The Isaacs-Kidd Midwater Trawl designed by the late Professor John Isaacs and engineer Lewis Kidd of the Scripps Institution of Oceanography in 1951, has been used at the SWFC for collecting juvenile fish. Although the trawl is capable of collecting juvenile fish, two factors limit its capability as a quantitative sampler. First, it cannot be used to sample the upper 3 to 4 m of the water column unless the ship is equipped with a large and sturdy boom amidships. Otherwise the net would be towed in the wash immediately behind the screws of the towing vessel. Second, the bridles attached to the depressor cross in front of the net's mouth opening, and the depressor create a pressure wave immediately in front of the net. These latter factors probably increase the fishes' ability to detect and avoid the net.

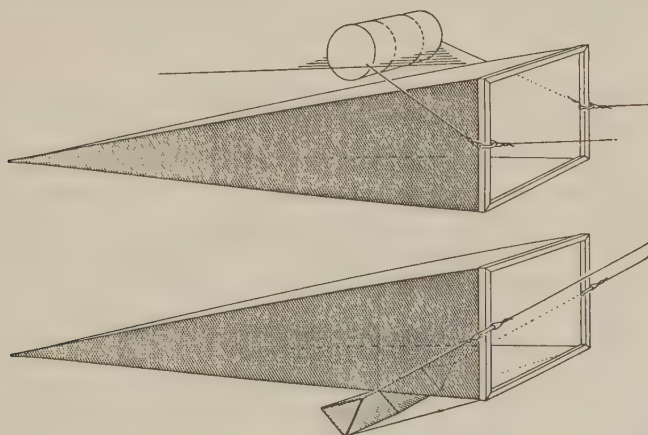


Figure 1. Two configurations of the new micronekton sampler: surface towing (top) and subsurface towing (bottom).

Dr. Richard Methot, Fishery Biologist, has designed an alternative configuration (Figure 1) which greatly reduces the limiting factors. The new configuration depends on the addition of a rigid frame around the mouth of the net. The length of the tow bridle is increased to about 12 m and is attached to the frame in only two places, the midpoints of the two sides. The use of a long bridle reduces the amount of the mouth area obstructed by the bridle. The symmetric attachment achieves a vertical mouth opening through the forces acting on the net. The two sides of the bridle extend about 3 m past the mouth opening and are attached there to the two sides of the depressor from an Isaacs-Kidd midwater trawl. Thus the depressor is towed behind and below the net. The depressor maintains its proper position by an additional pair of cables extending from the lower portion of the frame to the depressor. To use the net near the surface, the depressor is detached and the extensions of the bridle are attached to a large float. In this latter configuration the float is towed above and behind the net's mouth.

A model of the net with depressor was built and tested in the flume in the SWFC aquarium. A prototype of the net is being built and testing is planned for January on the NOAA Ship David Starr Jordan.

Estimates of Abundance for Pacific Mackerel Underestimated from 1977 to 1983

Alec MacCall and Richard Methot of the Coastal Division and Richard Klingbeil of the California Department of Fish and Game have reestimated Pacific mackerel abundance by applying cohort analysis to the most recent fishery data. The results indicate that abundance estimates were erroneously low from 1977 to 1983. Because fishery catch quotas are set according to a formula based on estimated abundance, catch quotas for those years were lower than they would have been if abundance estimates had been more accurate. However, if fish are not harvested in one year, a substantial portion of those fish can be harvested later. This results in an interesting question: Would recent catches have been different if quotas for 1977 to 1983 had been set without error?

MacCall has done the calculations necessary to answer this question. Given the relative availabilities of various ages of fish and the reproductive success, historical abundances can be simulated for different harvests. The simulated quotas, based on the true abundance as modified by prior fishing, show that harvests would have been considerably larger than actual catches from 1977 to 1982 (Figure 1). However, the cumulative effect of these removals would have resulted in much smaller catches than were actually taken in the 1983 and 1984 fishing seasons, when abundance would have been driven to low levels. In effect, the fishery is now benefiting from the catches which were unintentionally foregone in the past few years. The pattern of actual abundance estimates and consequent quotas has produced a relatively large and stable fishery over the last six years--an unusual pattern for a fishery which historically has been erratic.

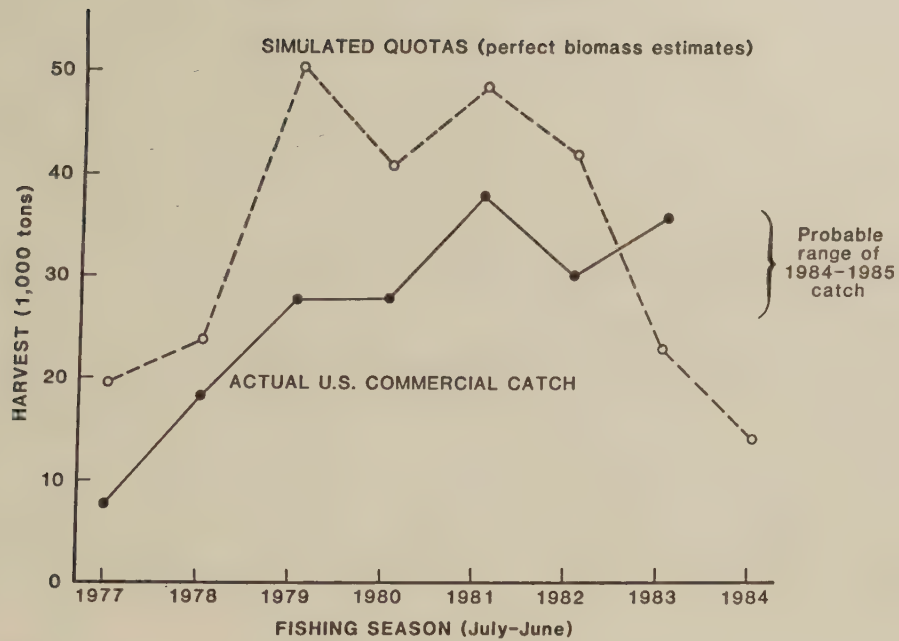


Figure 1. Comparison of actual U.S. commercial catches of Pacific mackerel with simulated catch quotas if abundance had been estimated accurately.

OCEANIC FISHERIES RESOURCES DIVISION

La Jolla, California

Center Scientists Attend Atlantic Tuna Commission Meetings

Southwest Fisheries Center scientists Drs. Izadore Barrett, Pierre Kleiber, Norman Bartoo, and Gary Sakagawa participated in the Fifteenth Regular Meeting of the Standing Committee on Research and Statistics (SCRS) of the International Commission for the Conservation of Atlantic Tunas (ICCAT), held October 28 to November 7, 1984, in Las Palmas, Canary Islands, Spain. Immediately following the SCRS meeting, the Commission held its Fourth Special Meeting from November 7-13. Sakagawa attended the Commission meeting as a technical advisor to the United States Commissioners.

During the SCRS meeting, Center scientists served as rapporteurs, convener of the subcommittee on Statistics, and technical experts on tropical tunas and albacore for discussions on the current condition of tuna stocks fished in the Atlantic Ocean. The SCRS concluded that the stock of yellowfin tuna in the eastern Atlantic was fished near its maximum potential as of 1983. In 1984 nearly 50% of the effective fishing effort has transferred to the Indian Ocean and catches from the eastern Atlantic stock have been much lower than the maximum. This should allow the stock to increase.

Bigeye tuna stocks were determined to be nearly fully exploited with existing fishing gears (predominantly longlines) and patterns of fishing. A reduction in fishing effort by surface gears in 1984 is expected, although significant reduction in bigeye tuna catches is not expected. The stocks of skipjack in the Atlantic were determined to be only moderately exploited with potential for additional catches. Atlantic albacore stocks are nearly fully exploited by current fisheries in the Atlantic. Some additional catches are possible from the south Atlantic if the surface fishery expands.

Marine Mammal Assessment Investigations

California Sea Lion Food Habits Studied

The Staff of the Coastal Marine Mammal Project at the SWFC has been conducting studies on the food habits of the California sea lion at San Clemente Island since September 1981. Mark Lowry and Chuck Oliver, Fishery Biologists at the La Jolla Laboratory, have been analyzing sea lion scats which had been collected from September 1981 to March 1983. Prey composition and temporal differences in the diet of the sea lions were investigated.

Fish otoliths and cephalopod beaks were removed from 438 scats by washing with a set of different sieves (2.8 mm, 1.4 mm, and 1.0 mm). The otoliths and beaks were tabulated and identified to family or species. The results indicate that sea lions on San Clemente Island fed principally ($\geq 21\%$ by occurrence and $\geq 22\%$ by number) on northern anchovy (*Engraulis mordax*), jack mackerel (*Trachurus symmetricus*), and market squid (*Loligo opalescens*). Also occurring frequently ($<14\%$ by occurrence and $<5\%$ by number) were hake (*Merluccius productus*), Pacific mackerel (*Scomber japonicus*), rockfish (Scorpaenidae), and blacksmith (*Chromis punctipinnis*). Other prey species identified, but occurring at very low levels ($<3.0\%$ by occurrence and $<0.5\%$ by number) were the pelagic red crab (*Pleuroncodes planipes*), flatfishes, senorita (*Oxyjulis californica*), surfperch (Embiotocidae), silversides (Atherinidae), spotted cusk eel (*Chilara taylori*), seven species of squid and octopus.

Temporal differences were found in the diet. Jack mackerel were important from May to December; market squid in October 1981, May to June 1982, and December 1982 to January 1983; and northern anchovy from February to March, July, and October in all years (Figure 1). Pacific mackerel, hake, rockfish, and blacksmith fluctuated in the diet during the study period.

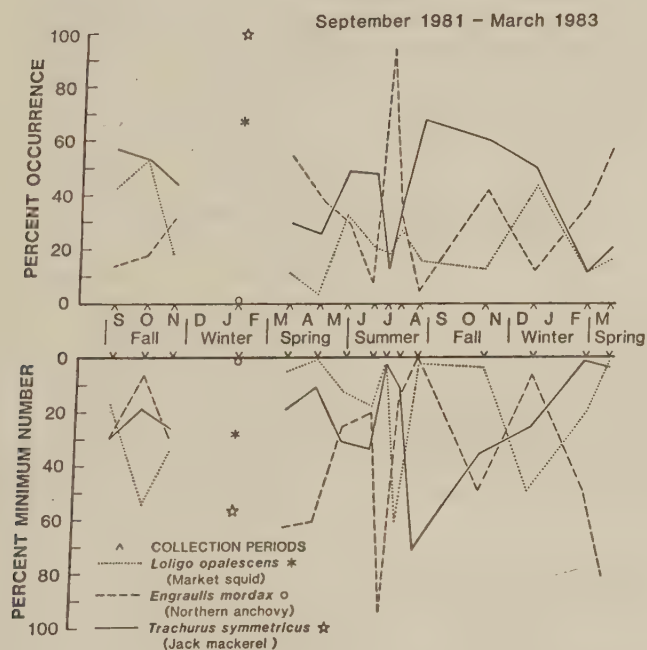


Figure 1. Temporal variability of percent occurrence and percent minimum number for the three major California sea lion prey species identified from scats collected at the San Clemente Island rookery from September 1981 to March 1983.

The El Niño of 1982-83 had an effect on the diet of the sea lions. Significant levels of pelagic red crab, which is associated with the warm water, began appearing in the scats in February (25%) and March (21%) 1983. Before February, pelagic red crabs were completely absent from the diet. Preliminary inspection of data collected since March 1983 indicates that the occurrence of pelagic red crab in the diet continued into 1984.

Results of Tuna Food Habits Study Presented at CalCOFI Meeting

Hannah Bernard, Biological Technician, presented preliminary results of a food habits study of scombrid fishes at the annual CalCOFI Conference in October. Skipjack (Katsuwonus pelamis) (n=31), Pacific bonito (Sarda chiliensis) (n=42) and albacore (Thunnus alalunga) (n=94) were collected with troll gear off the coast of southern California during cruise 166 of the NOAA Ship, David Starr Jordan, in August and September 1983.

The stomach contents were rough-sorted and the percent occurrence and the percent frequency were determined in the laboratory. In addition, percent volume of fish consumed was determined for albacore. Chi-square analysis for homogeneity showed highly significant differences in types of prey and proportions consumed by the scombrids. Crustaceans (especially euphausiids) appeared more frequently and in greater numbers in the stomachs of bonito and skipjack than in albacore stomachs. Location of capture might have produced this difference because the skipjack were caught south of Pt. Conception in the Southern California Bight and albacore and bonito were caught north of Pt. Conception.

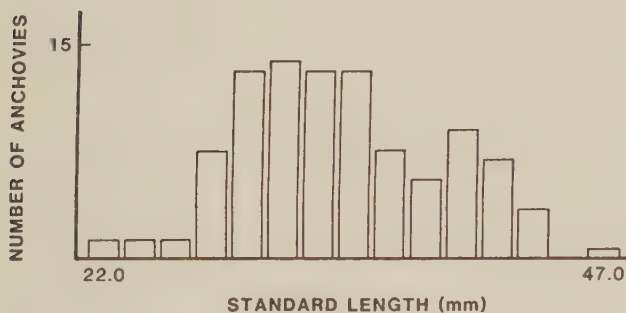


Figure 1. Length-frequency distribution of northern anchovy (Engraulis mordax) obtained from gut content analysis of 85 albacore caught during August-September 1983, off the coast of southern California.

The primary prey item in the diet of albacore was fish. An Index of Relative Importance (IRI = sum of percent number of prey and percent volume of prey multiplied by the percent frequency of occurrence of the prey) was calculated for prey items in the diet. The results showed that northern anchovy was consumed almost as much in quantity and frequency as all other fish species combined (IRI for anchovies = 7360.32; IRI for all other fish = 8061.76). Young-of-the-year anchovy (mean standard length of 33.6 mm, S.D. = 4.97, range = 22.0 - 47.0 mm) were found exclusively in the diet (Figure 1).

Ecological Fishery Systems Investigations

Scientist Investigates Large-Scale Spatial-Temporal Patterns in Distribution of Dolphins

Dr. Steve Reilly, Operations Research Analyst, is conducting research on the seasonal and spatial variation in dolphin distribution and relative abundance, and how this variation relates to the marine environment.

Preliminary results suggest that there are significant seasonal changes in dolphin distribution and relative abundance in the eastern tropical Pacific (ETP) and that the existence of an El Niño-southern oscillation condition has noticeable effect on the seasonal patterns.

Reilly hypothesizes that much of the observed pattern and variability in ETP dolphin distribution and relative abundance is related to major physical features of the environment. This hypothesis is being tested through statistical comparisons of dolphin school encounter rates from tuna vessel observer data and about 30 measured or derived variables representing the physical oceanography of the ETP. If his investigation provides positive results, Reilly plans to execute a second phase of his research, that of testing the hypothesis with smaller scale, more "real-time" data, such as data gathered from a single research vessel cruise in the ETP. For this future effort, satellite imagery will be an important tool.

Data Analyzed on Dolphins Tagged in ETP

From 1969 to 1978 Southwest Fisheries Center personnel tagged dolphins in the eastern tropical Pacific (ETP) from tuna purse seiners. Data on release and resightings were recently organized and a comprehensive computer database was prepared as a first step in reanalysis of the data by fishery biologist John Hedgepeth. The database is in three parts: releases, resightings, and recoveries. A CPM-operating system microcomputer program called dBASE-II was used to construct the three files; linking was accomplished through common data-fields shared among the files.

The data base has been used initially to review sightings of dolphins tagged in the 1978 dedicated vessel cruise of the tuna purse seiner, Queen Mary. The majority of the sightings were of spotted dolphins. There were also two westernmost sightings, which are unconfirmed sightings made shortly after tagging operations, and a single sighting was made of an eastern spinner dolphin near the coast of Mexico (Figure 1).

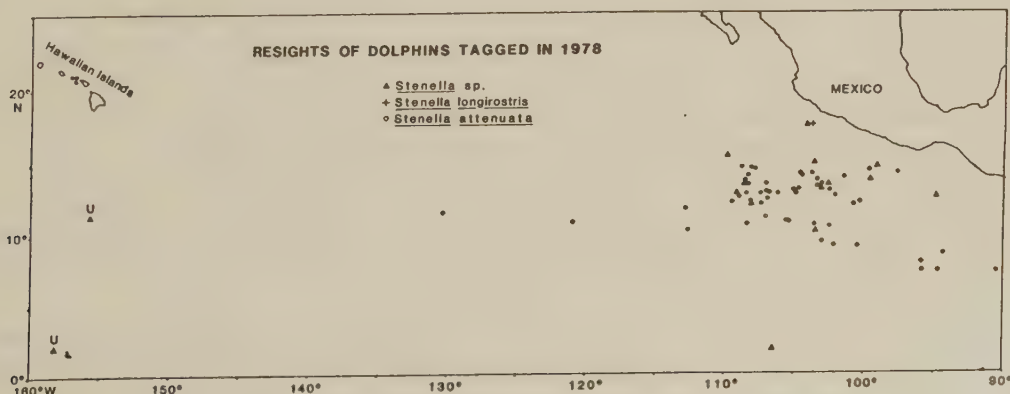


Figure 1. Locations of resightings of dolphins tagged in 1978. The two westernmost resightings are unconfirmed, here labeled with a U. Points may indicate resightings of more than a single animal.

The tags used were bright orange or yellow disks, 6.2 cm diameter; pairs were fixed on either side of the dorsal fins and held together with a single bolt through the fin. There were 651 tags released and 115 subsequent sightings of the tagged animals. Only a single recovery, approximately a year after release, has been reported.

Preliminary analysis of the sightings data show a principal east-west movement with dolphins tending to move offshore in the late spring to early summer, as was first suggested by Dr. William Perrin and others at the Southwest Fisheries Center, and an inshore movement in the winter.

New Cohort Analysis Programs Written for La Jolla Standard Microcomputer

Computer assistant Susan Chivers has completed translating two useful cohort analysis programs into FORTRAN-77 on the Super-La Jolla Standard Microcomputer. The programs were originally designed by fishery biologist Pierre Kleiber to perform cohort analyses by forward and reverse solutions. Both programs have several options for displaying the results. The output may be listed directly on the screen or printer, sorted on a disk file, or displayed graphically on the screen. The plotting routine is designed specifically for the Zenith H-29 graphics terminal.

Biological Systems Investigations

Use of mtDNA in Stock Differentiation Investigated

Dr. Andrew Dizon, Fishery Biologist, reports that a survey of 0-restriction endonucleases in 30 samples of spinner dolphin (Stenella longirostris) from the eastern tropical Pacific Ocean has demonstrated 6 polymorphic restriction enzymes so far. Restriction endonucleases with polymorphic digestion patterns identified in these samples will be used in a more extensive testing of incoming samples to determine if distinct stocks exist within the eastern Pacific.

Steve Londino, Porpoise Observer, recently brought back 117 well-preserved tissue samples of S. longirostris and spotted dolphin, S. attenuata, which had been collected in the eastern tropical Pacific. Gina Battista, Biological Technician, has isolated high molecular weight genomic DNA from 20 of these samples and is currently processing 12-15 samples per week. When completed these samples will form the basis for intensive investigations of restriction enzyme profile frequencies. Only enzymes determined to be polymorphic in the initial survey of the above 30 S. longirostris will receive attention.

Dr. Sarka Lucas, Consultant, reports that both the cloned and purified mtDNAs of common dolphin, Delphinus delphis, and Commerson's dolphin, Cephalorhynchus commersonii, have been mapped for the cleaving sites of seven restriction endonucleases. These maps will be used to align delphinid mtDNA with the published sequences of other mammals (human, cow, and mouse) for further studies.

Dr. John Graves, Oceanographer, reports that he has now purified mtDNA from nine albacore taken off Cape Town, South Africa. Ten additional albacore samples (five from San Diego, five from Cape Town) await purification before preliminary restriction enzyme analysis can demonstrate differentiation between the San Diego and Cape Town albacore with the use of restriction enzyme analysis, the technique may be used to investigate albacore stock structure within the North Pacific.

Marine Animal Sightings and Geomagnetic Field Analyzed

Dr. Michael Walker, NRC Fellow at the Southwest Fisheries Center, reports results of preliminary analyses of associations between pelagic marine animal distributions and patterns in the magnetic field of the earth of the U.S. east coast. Marine animal distribution data were taken from sightings within the Cetacean and Turtle Assessment Program (CETAP) data base supplied by Dr. Richard Kinney, University of Rhode Island. The data base, containing more than 24,000 records, included position and identifications of cetaceans, turtles, pinnipeds, and fishes collected on dedicated aerial survey flights made from 1979-1981 over the continental shelf and slope from Cape Hatteras, North Carolina, to the Gulf of Maine. Sightings from the dedicated surveys that were identified to species (with the exception of pilot whales, Globicephala sp.) were partitioned trimesters corresponding to the four seasons (December-February, March-May, June-August, and September-November). Sample sizes arising from treatment were predominately 20-150 sightings. Sample sizes were below 20 most often for large whales and above 200 only for ocean sunfish, Mola mola, and loggerhead turtles, Caretta caretta.

Magnetic data from the Continental Margin (USGS Open File Report 82-189) were obtained from Dr. David Clark, NOAA, National Geophysical Data Center, Boulder, Colorado. Using VAX 11/780 computer image processing facilities and software provided by Drs. J.A. Westphal and J.L. Kirschvink, California Institute of Technology, sightings from the CETAP data set were plotted on maps of the geomagnetic data, permitting visual analysis of the distributions of the species with respect to the geomagnetic field. Statistical analyses were conducted by adapting a contour index (previously used to investigate interactions between cetacean distributions and depth) so that it can be used with magnetic field data.

Plots of sighting positions for which magnetic field data are available suggested several patterns of distributions of species with respect to the geomagnetic field. Mysticeti whales appear to avoid areas of high magnetic field intensity in all seasons. In contrast, some odontocetes (sperm and pilot whales in particular) and also ocean sunfish are associated with areas of high magnetic field intensity off Cape Hatteras in winter, but these species avoid other similar features in all other areas and in all seasons. Sea turtles and sharks are found almost exclusively in areas of low magnetic field intensity. The magnetic contour index developed for this study proved to be very sensitive in detecting statistically significant patterns. Because the CETAP data set does not contain accurate depth information it is not possible to determine whether the association with magnetic field patterns is an artifact of patterns arising from preferential associations of the animals with bathymetric

features. Data from the SYNBAPS Global Gridded Bathymetric Data Set are being requested so that this possibility can be tested directly.

Study Shows That Swimming Helps Dolphins Stay Warm

Drs. Elizabeth Vetter, Operations Research Analyst, and Pierre Kleiber, Fishery Biologist, report that they have used a new 32-bit Stride Microcomputer to develop a size-specific mode, predicting energy costs of non-steady swimming near the surface by spotted dolphins. Previous models have considered only costs of swimming and constant speed and depth. The Vetter-Kleiber model predicts path velocity and added drag as a function of animal size, surface speed, breathing period, and maximum depth of dive.

Heat budgets for spotted dolphin indicate that standard metabolism and specific dynamic action do not generate enough heat to replace estimated passive heat losses. These small tropical cetaceans cannot maintain thermal equilibrium unless they generate additional heat through active metabolism. This heat can be generated by steady submerged swimming at approximately 160 cm/sec^{-1} , but this speed exceeds by about one-third observed average speeds, measured as straight paths across the oceans surface, of 120 cm/sec^{-1} . Incorporating the additional costs of non-steady (sinusoidal) swimming to observed depths and surfacing to breathe at observed frequencies balances the budget. Observations of dolphin behavior, in situ, in laboratories and oceanaria, and observations of thermal dynamics in restrained and free-swimming dolphins support the conclusion that activity is a necessary component of the heat budget for many of these small cetaceans.

Wild Dolphins of Known Age Used to Test Age Determination Technique

Teeth from a sample of wild bottlenose dolphins, Tursiops truncatus, of known age are being analyzed by zoologist Aleta Hohn to test the accuracy of age estimates from growth layers (GLGs) in length. This work is part of a fifteen-year study by Blair Irvine, University of Oregon, Randy Wells, University of California at Santa Cruz, and Michael Scott, IATTC, on a discrete population of bottlenose dolphins in Sarasota Bay, Florida. Begun in 1971, a group of animals has been studied through use of tagging, radio-tracking, and repeated observations. So far, results from the study have yielded reproductive and mortality data and the most detailed description of dolphin social structure currently available.

Teeth were collected from 19 of 42 dolphins captured during this summer's capture operations. Seven of the 19 had been previously captured, either in 1970-71 or 1975-76. The 19 teeth were decalcified, sectioned, and stained using standard procedures developed by Marine Mammal Age Determination Lab, headed by Dr. Albert Myrick, at the SWFC. An additional 5 more teeth collected earlier from five animals from this same population were also processed.

Before the teeth were read for age estimates, they were coded from 1 to 24 to remove their collection numbers and any information that might bias the reading for age. The teeth were then read by Hohn in the blind,

that is, without access to information on the specimens or how many of the teeth came from the tagged-recaptured animals. The ages estimated from the readings of dental GLGs exactly matched or approximated the known ages and were close to expected minimum known-ages for 12 specimens. The ages of the animals ranged from 2.2 to 33 years.

Multispecies Data Management and Fisheries Monitoring Program

Status of 1984 Tuna/Dolphin Observer Data Reported

Biological technician Al Jackson reports that for the month of November one tuna/dolphin observer assigned to the Inter-American Tropical Tuna Commission (IATTC) departed on a U.S. boat and one NMFS observer returned. Three NMFS observers and two IATTC observers are at sea as of November 30. The status of NMFS tuna/dolphin observer cruises for this year is:

Cruise number	Vessel depart	Vessel return	Data received	Database load
844	4-29-84	6-13-84	6-22-84	9-24-84
887	5-09-84	7-28-84	8-13-84	11-19-84
888	5-10-84	7-23-84	8-08-84	11-19-84
889	5-10-84	6-25-84	7-06-84	9-24-84
890	6-04-84	8-22-84	8-31-84	11-19-84
891	6-26-84	10-19-84	10-19-84	11-19-84
892	8-03-84	9-19-84	9-28-84	11-19-84
899	9-22-84	11-19-84		
900	10-16-84			
901	10-23-84			
902	10-25-84			
Total	11	8	7	7

A computer program CRUIZERPT was used to produce a summary report of each of the seven observer cruises contained so far in the 1984 data bases. This program examines various information collected by the observer. Information from the individual cruises was assembled to produce the following summary:

- 7 cruises
- 440 days at sea
- 257 sets (all types)
- 222 dolphin sets
- 6,351 tons tuna caught
- 2,291 hours marine mammal watch effort

953 marine mammal sightings
149,071 dolphin chased (observer estimate)
121,346 dolphin captured (observer count)
1,517 dolphin killed (observer count)
390 dolphin life history specimens collected

Not currently available on the SWFC data base are data from U.S. cruises that were assigned to IATTC observers. IATTC observers have completed 14 cruises aboard U.S. flag seiners to date.

PACIFIC ENVIRONMENTAL GROUP

Monterey, California

Researchers Note General, Long-Term Warming of Coastal Waters

Recent studies conducted by Dr. Douglas McLain, Jerry Norton, and Rusty Brainard have described a general long-term warming of the coastal waters off the west coast of North America following the cold water conditions of the early 1950's. The anomalously warm water of the El Nino in California following the winter of 1982-1983 and the similar conditions which followed the winter of 1957-1958 can be considered transient peaks in a general coastwide warming trend.

The researchers consider the trend to be on a large spatial scale, traceable from the tropics to the Gulf of Alaska, more obvious at subsurface depths of 50 to 100 m than at the sea surface, and indicating a general deepening of the thermocline in coastal waters. The trend is also traceable in sea level observations from coastal tide gauges. Sea level is an excellent indicator of such changes since such observations are abundant and inexpensive and because sea level represents a vertical integral of the thermal structure. Time series of sea level, however, are subject to misinterpretation owing to long-term changes associated with geological processes.

McLain, Norton and Brainard believe that the warming trend causes two processes which have biological implications. First, deepening of the thermocline adjacent to the coast changes the slope of the thermocline normal to the coast; this in turn causes an increased tendency for northward-flowing coastal currents which transport warm water and tropical organisms northward. Second, the deepened thermocline reduces the ability of the winds to cause upwelling of nutrient-rich deep waters and consequently reduces the biological productivity of the surface waters. Dr. W. Quinn at Oregon State University has theorized that changes in fish populations off South America in recent years have occurred in conjunction with the large-scale temperature fluctuations.

The causes of the ocean warming remain unclear but the large-scale circulation pattern over the Pacific has apparently changed producing conditions in recent years which can give rise to an El Niño. For example, the Southern Oscillation Index, which is inversely correlated with the warming trend, has been below normal since 1976. Warm water conditions in the eastern tropical Pacific may be associated with a warming off California by both oceanic and atmospheric processes. In the ocean, a depression of the thermocline may move northward from an El Niño event in the tropics as a coastally trapped Kelvin wave and cause the thermal structure off California to deepen. However, observations of subsurface temperature which can support the idea of a propagating Kelvin wave are few.

In the atmosphere, tropical warmings are often associated with intensification of the Aleutian Low pressure system and weakening of the North Pacific High (Horel and Wallace, University of Washington). These conditions favor increased shore transport of warm surface waters to the coast and deepening of the thermocline. The relative contribution of these two processes as factors in the warming of the water off California is presently a matter of dispute although it seems the atmospheric processes may play the more important role. During the 1982-1983 winter, onshore transport along the California coast was the greatest in any winter within the period of record, 1946-1983.

In conjunction with the work on warming trends, scientists at PEG are also investigating the utility of sea surface temperature data from shore stations in monitoring coastal ocean conditions. In cooperation with Drs. Larry Breaker and Peter Lewis at the Naval Postgraduate School, time series of monthly mean sea surface temperatures (SST) at two California shore stations, Granite Canyon and southeast Farallon Island, are being related to time series of monthly mean surface and subsurface temperature for a series of averaging areas at various distances and depths offshore from the shore stations.

Although there is strong seasonal variation, SST at the shore stations correlates well with temperatures in the surface mixed layer offshore. In winter, the correlation coefficients were greater than 0.6 with a surface layer of about 100 m in depth and extending to 200 km offshore. In summer, the correlation coefficients were lower (0.4 to 0.6) and related to a thinner surface layer (25 to 50 m deep) and extending to 400 km offshore. These changes apparently reflect the formation of a shallow seasonal thermocline in summer above a deeper, permanent thermocline. Winter shore station SSTs also correlate well with a narrow (less than 100 km wide,) deep (100 to 44 m depth) band along the coast, coincident with the California undercurrent. Shore station SST data thus can be used to monitor the surface mixed layer along the coast and provide a fair index of undercurrent temperature in winter.

TIBURON LABORATORY

Tiburon, California

Physiological Ecology Investigation

Striped Bass Livers Analyzed for Selenium Levels

In recent months, there has been increasing concern over effects of agricultural runoff from the San Luis Drain on wildlife in the Kesterson National Wildlife Refuge. It has been proposed that this runoff be emptied into San Francisco Bay, which would pose a possible threat to the rest of the Bay-Delta ecosystem.

The Bay Institute of San Francisco arranged to have striped bass livers, which had been archived at the Tiburon Laboratory, analyzed for selenium, a trace element identified in the agricultural wastewater thought to contribute to deleterious effects in some wildlife. A sample of 20 livers from striped bass collected in 1979, 1981, 1982, and 1983 from the Delta were analyzed. Another 10 livers from striped bass caught in the Coos River, Oregon (1980), Chesapeake Bay (1981), and the Hudson River, New York (1982) were also analyzed. Dr. Jeannette Whipple analyzed the concentration data provided by the Bay Institute.

After analyzing the data, Whipple found that higher selenium concentrations were correlated with reduced liver condition, as seen in previous analyses of concentrations of zinc, copper and other heavy metals in striped bass. The high selenium level also was correlated with greater total severity of parasitization and with a higher incidence of other anomalies in the fish.

Although the differences in selenium concentrations were not statistically significant among areas, Coos River and Chesapeake Bay samples appeared to have lower levels than San Joaquin and Hudson River fish. The small sample size prevented significant results in comparing sample sites. Finally, she found that differences among years of the samples in the San Joaquin River were insignificant, as were the effects of age, size, or sex of the fish in all areas.

In general, the results of the analysis were inconclusive and Whipple recommended that further research on selenium be carried out by the California Department of Fish and Game in the striped bass monitoring program.

Briefings Underway on Groundfish Research and Fishery

A series of informational meetings on research and management began in November as part of a new program on the physiological ecology of groundfishes at the Tiburon Laboratory. Staff from the Laboratory and guests from outside agencies will lead discussions on relevant topics and provide current information to groundfish researchers. An initial presentation was given by fishery biologist William Lenarz on the population dynamics of groundfishes. Future briefing topics include sampling design, economics, management, biology, and physiology.

Underutilized Fisheries Resources Investigation

Studies Determine Krill Abundance off Central California

Euphausiids (krill) are among the major forage species in the California Current. Hundreds of tons of Antarctic krill (Euphausia superba), as well as the smaller North Pacific krill (E. pacifica), are imported annually from Japan and Canada as feed for aquarium fishes.

Studies conducted by biologists at the Tiburon Laboratory have shown that E. pacifica and Thysanoessa spinifera, another small euphausiid, are abundant between Monterey and San Francisco during certain times of the year. Task leader Sus Kato and Bill Leet of the Tiburon Laboratory have identified prospective buyers for these krill, and are presently aiding a commercial fisherman from Monterey in making preparations to catch euphausiids. The fisherman will use a net and other gear from the Tiburon Laboratory, and Kato and Leet will also provide assistance in fishing, as well as on-board handling techniques to assure that the product is of high quality. Fishing trials will probably be initiated in December.

Fish Communities Investigation

Distribution of Shortbelly Rockfish Found Related to Diel Migrations of Euphausiids

The shortbelly rockfish, Sebastes jordani, follows euphausiids, its major prey, during diel vertical migrations centered at submarine canyons that cut into the coastal shelf of central California. In an analysis of data collected by the staff of the Predator/Prey Task, fishery biologist Tony Chess has determined that at night the shortbellies prey on euphausiids that have risen out of the canyons and have been displaced over the adjacent shelf by prevailing currents--generally northward by the California Current (Figure 1). At daybreak the shortbellies accompany the euphausiids in their descent, and continue to feed on those that concentrate close to the bottom on the shelf. Apparently the euphausiids that had been displaced away from the canyon are blocked from descending to their normal daytime depths, and are, in effect, trapped by the shelf. They become vulnerable in this position as indicated by sharply increased feeding in the shortbellies that accompany them at this time. These trapped euphausiids appear to be in discrete aggregations, judging from the aggregated distribution of the shortbellies that feed on them (Figure 2).

Undoubtedly other mesopelagic organisms that migrate into the surface water at night are then carried over the shelf by the prevailing currents. And, like euphausiids, probably many of these organisms are trapped on the shelf in the morning to become ready prey of shelf predators. Certainly the spatial and temporal pattern of availability of this renewable food resource must strongly influence the distribution of many fishes on the shelf.

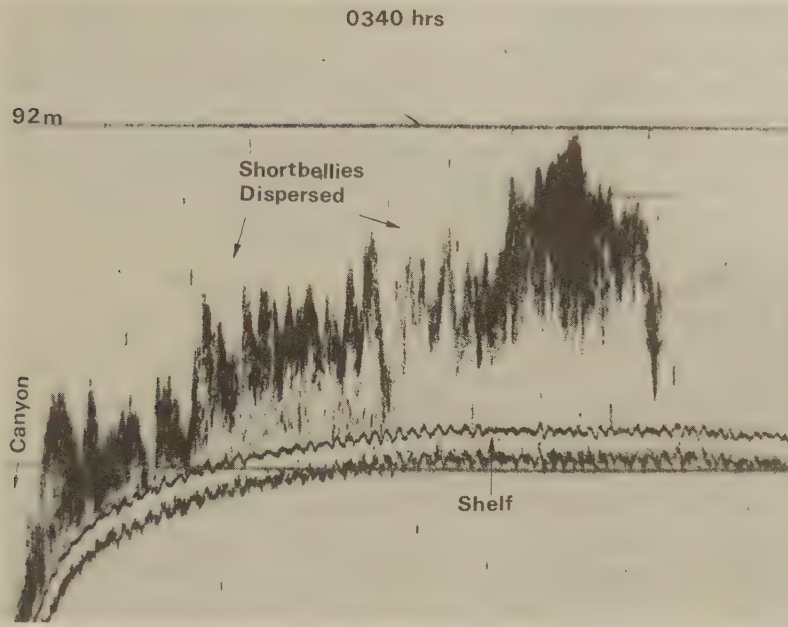


Figure 1. Hydroacoustic tracing, nighttime.

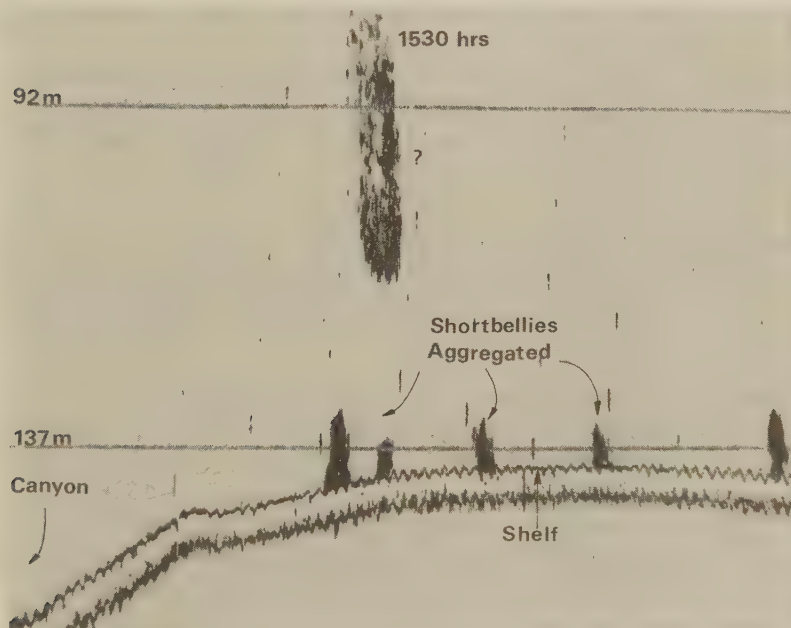


Figure 2. Hydroacoustic tracing, daytime.

Groundfish Analysis Investigation

Rockfish Ageing Techniques Reviewed

Fishery biologist Tina Echeverria of the Rockfish Analysis Task met with two biologists from the California Department of Fish and Game to review the current ageing techniques for rockfish. Echeverria compared surface ageing and break-and-burn techniques for ageing Sebastes paucispinis, S. levis and S. rosaceus, and discussed problems concerning the age verification of Sebastes with emphasis on the subgroup Sebastomus of which S. rosaceus is a member. In 1979 researchers at the Tiburon Laboratory attempted to construct a growth curve for S. rosaceus using various structures and techniques without success. The break-and-burn technique was not tried. The surface reading of the otolith appears to be the most promising technique because it gave the most consistent results during the 1979 study.

FISHERIES INFORMATION SYSTEMS & ADP

News in Brief on ADP Activities

Computer programmer Rob Bistodeau attended an informative 5-day training class on the Molecular 32X computer in San Jose, California. It appears that most of the Center's problems with the 32X may be due to "bad" application processors (APs), which are locking up the bus...Cables have been installed connecting the offices of the Technical Support Group and the secretarial staff to the La Jolla Laboratory's Super-Microcomputer Molecular 32X. For the Technical Support Group and the Oceanic Division, a switch has been installed to permit the sharing of a NEC letter-quality printer...Susan Iacometti, Computer Systems Programmer, tested a communication software package written by Jack Brown, La Jolla-X (LJX). LJX is used for the transfer of files between the Super-Microcomputer and a La Jolla Standard Micro...Iacometti trained current users on WordStar and LJX, using the Super-Micro system; she will train the other secretarial staff when they are eventually linked to the Super-Micro...Bistodeau met with executive officer Ben Remington to discuss the start-up procedures for the Financial Reporting System for FY 1985...Iacometti is processing the 1982 California data for inclusion with Washington and Oregon data sets in the PACFIN system.

Dorothy Roll, Computer Systems Analyst, has prepared and distributed to the staff procedures for the procurement of ADP equipment, service and software...the Shipboard Requirements Committee members, with Roll as Chair, met on November 13 to discuss the status of their recommendations to the Director for implementing the 15-8 as the shipboard data collection system; as of this writing, only the power saver and tape drive have been purchased.

Production Data from Vessels Participating in the Joint Venture Fisheries on Pacific Whiting to be Included in PACFIN

A proposal was put forth by Charles Korson of the Southwest Region to incorporate data from individual trawl vessels participating in the joint venture fisheries on Pacific whiting off Washington, California, and Oregon into the SWFC's PACFIN research data file. Following this suggestion, a meeting was held on November 21 between Jerry Hornoff, Systems Analyst with the Southwest Fisheries Center on detail to the SW Region, and Joe Terry of the Northwest and Alaska Fisheries Center, to set up the requirements for entry of production data. Joint Venture Daily Receipt Logbooks are available for the period 1979 through 1984.

Pacific Islands Fishery Officials Visit WPACFIN Office

The outgoing Chief of the Yap Marine Resources Division, Roger Pflum, and the Acting Chief, John Iou, visited David C. Hamm, Computer Systems Analyst, to discuss implementation of data collecting and processing systems in Yap. The Yap fishery officials are implementing a system similar to Western Pacific Fishery Information Network (WPACFIN) systems in American Samoa, Guam, Saipan, and Palau.

Bob Carpenter, new Chief of the Office of Marine Resources in Majuro, Marshall Islands, also visited Hamm to discuss fishery statistical systems. The Marshall Islands recently received a P.L. 88-309 grant from the National Marine Fisheries Service to establish data collecting and processing systems in Majuro and possibly other islands in the Marshalls. Carpenter would also like to establish WPACFIN-compatible systems to facilitate possible data exchange in the future.

* * * * *

Hamm reports that the development of central WPACFIN data bases and processing systems on the Honolulu Laboratory Molecular computer continued during the past month. New summary data bases have been created for commercial landings data, and the data for a few years have been summarized and entered in the files. Commercial landings data from the Northern Mariana Islands were transferred from Apple data bases to the central data bases on the Molecular.

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The final drafts of user's and programmer's guides for the Guam Offshore Expansion System (GOES) were forwarded to the Guam Division of Aquatic and Wildlife Resources. Both guides contain detailed documentation of GOES, including numerous system and program flow charts. Also, the "WPACFIN organization and design, status and issues" paper that has been used as a planning and discussion document was revised. The revised version will be used as a discussion paper for the December meeting of the WPACFIN Fisheries Data Coordinating Committee.

ADMINISTRATIVE ACTIVITIES

A-76 Update

During November, NMFS reviewed the SWFC recommendations and comments on the final Arthur Young Management Efficiency Study. On November 20, NMFS forwarded these recommendations and comments to James Winchester, Associate Administrator of NOAA, for his consideration.

Although formal documentation is lacking, the Center has been advised that the Arthur Young and Co. contract to complete the SWFC A-76 review has been terminated, and no further participation by Arthur Young and Co. is expected. Instead, the completion of the Management Efficiency Study (Phase I), and the subsequent Phases (Performance Work Statement and Cost Analysis) required to complete the review will be handled by another reviewer, yet to be designated. It is possible that the remaining work may be undertaken by NOAA.

MISCELLANEOUS

Public Affairs

La Jolla Laboratory

Dr. John Graves, Oceanographer, was invited to give a seminar at Scripps Institution of Oceanography on November 16, 1984. During his presentation entitled "When the gene pool leaks: Inter- and intra-specific investigations of fishes using restriction endonuclease analysis of mitochondrial DNA," Graves discussed the application of restriction analysis of mtDNA to fisheries biology and presented the results of his investigations on bass (Paralabrax sp.) and skipjack (Katsuwonus pelamis).

Press Release

Honolulu Laboratory

- November 13 - "NOAA Ship Completes First Leg of Research Cruise."
- 14 - "NOAA Ship Moves Monk Seals to Johnston Atoll."

Seminars

Honolulu Laboratory

- November 29 - Raymond Buckley and Lee Blankenship, Washington Department of Fish and Game, Seattle, Washington, spoke on "Applications of Northwest Marine Technology's internal coded wire tags in fisheries research."
- 30 - Dr. R.H. Mattlin, Fisheries Research Division, Ministry of Agriculture and Fisheries, Wellington, New Zealand, spoke on "The deep-water trawl fisheries of New Zealand."

La Jolla Laboratory

- November 15 - Dr. Rhonda Hageman, San Diego State University, gave a seminar on "Valuing Marine Mammal Populations: Benefit Valuation in a Multi-Species Ecosystem."

Pacific Environmental Group

- November 26-27 - Dick Parrish traveled to UC Irvine and gave two seminars as part of the Department of Ecology/Evolutionary Biology Guest Seminar Series. The seminars were entitled "Oceanic

climatology and fish production in eastern boundary currents" and "Environmentally induced variability in the life history rates of northern anchovy and Pacific mackerel."

Tiburon Laboratory

November 14 - Librarian Maureen Woods presented a review of ONLINE '84, a conference she attended in San Francisco the last week in October.

Some of the topics she discussed were the paperless office, electronic yellow pages, SCIMATE (available at the Tiburon Laboratory), NEDRES--a database produced by NOAA that accesses descriptions of environmental data files--and the Georgetown University Library Information System, a user-friendly computerized system for library patrons.

15 - Kathy Gerth, Biology Department of Dominican College, San Rafael, California, presented a seminar on "Impact of a sewage outfall on San Francisco Bay communities: Preliminary results of studies of the San Rafael outfall."

27 - Dr. Richard Bohrer, Alfred Wegener, Institute of Polar Research, Bremerhaven, Federal Republic of Germany, presented "Role of zooplankton in nutrient recycling in the lakes of the ocean."

30 - Dr. Edward Houde, National Science Foundation, spoke on "Biological oceanography: NSF opportunities."

Honors and Awards

Tiburon Laboratory

On November 2-4, Dr. Jeannette Whipple traveled to Cold Spring, New York, to participate in a workshop on striped bass and to receive an award from the Hudson River Fishermen's Association for work done on Hudson River striped bass in 1982. Dr. Whipple spoke on the work done in the San Francisco Bay-Delta area and compared results with those for striped bass in the Hudson River. The trip was sponsored by the Hudson River Fishermen's Association and the Hudson River Foundation.

Visitors

Honolulu Laboratory

November 5 - Dr. E.H. Hogue, Oregon State University, Corvallis, Oregon, visited Dr. Boehlert to discuss the Fishery Habitat Research Program and Ocean Thermal Energy Conversion research.

- 6 - Dr. Ted Dengler, University of California, Berkeley, California, visited Dr. Boehlert.
- 8 - Phil Johnson, Northwest Ocean Service Center, NOAA, Seattle, Washington.
- Greg Withee, National Ocean Service, Rockville, Maryland.

La Jolla Laboratory

- November 5 - John Carr and Tim Smith met with Mr. Ismael Benavides F., Minister of Fisheries, Lima, Peru.
- 8 - Masazumi Kimura, Deputy Director of the Fishery Department, Chiba Prefectural Government, Japan, visited Alec MacCall.

Pacific Environmental Group

- November 16 - Bob McAllister of California Department of Fish and Game visited Donna Mallicoate and Roy Mendelssohn to discuss rockfish data. Files of length-weight and length-age were transferred from California Department of Fish and Game DEC computer to the FNOC computer using a software routine called MOVEIT. This data transfer demonstrates a capability that may be useful in the future.
- 26-27 - Barb Engstrand, SWFC La Jolla, California, discussed administrative affairs with Rosemary Troian.

Tiburon Laboratory

- November 5 - Bjarne R. Jensen, Carroll Marine Company, met with Sus Kato to discuss trapping for spot prawn.
- 14 - Paul Gregory and Ray Allen, California Department of Fish and Game, Long Beach, California, met with Tina Echeverria to review ageing techniques for rockfish.
- Izadore Barrett and Dave Mackett, SWFC La Jolla, California, met with Norman Abramson to discuss development of groundfish strategic planning.
- 20 - David Summerville and Tom Wilson, Pacific Gas and Electric, Avila Beach, California, met with Tina Echeverria to discuss their projected work with juvenile rockfish.

Meetings and Travel

Honolulu Laboratory

- November 24 - Dr. Jeffrey J. Polovina departed for Thailand and the Philippines at the invitation and expense of the Asian Development Bank to examine feasibility sites in Manila and Bangkok for implementing artificial reef projects.
- 30 - Richard Shomura departed Honolulu for Bangkok to review status of tuna fisheries in Thailand, and Kuala Lumpur to attend Indo-Pacific Fishery Council meetings.

La Jolla Laboratory

- November 1-7 - William Perrin traveled to Madrid, Spain, to attend a meeting of the Species Survival Commission of the IUCN, and to London, England, to work at the British Museum.
- 3-7 - David Mackett traveled to Washington, DC, to deliver a speech at George Mason University, and visited F/S and F/PP to discuss planning and budget.
- 5-9 - John Carr traveled to Pascagoula, Mississippi, to attend a NMFS Vessel Committee Meeting.
- 12-17 - Steve Reilly traveled to Seattle, Washington, to represent the Center at the NWAFC/NMML program reviews.
- Dan Huppert went to Anchorage, Alaska, to present a paper to the Conference on "Fisheries Management: Issues and Options."
- 13-28 - Gail Theilacker visited Valparaiso, Chile, to present lectures and laboratory workshops on marine fish larvae for a course to be given at Universidad de Valparaiso.
- 16-19 - Chuck Oliver went to Coronado Island, and San Clemente Island, California, to conduct studies on sea lions.
- Jeanne Wexler traveled to San Clemente Island, California, to obtain counts, perform tag resights, collect scats and perform salvage of sea lions and elephant seals.
- 21-25 - Doug DeMaster met with a contractor in Pt. Reyes National Seashore to discuss elephant seal study and to develop a proposal for NSF.
- November 21- December 3 - Debra Losey attended a Federal Interagency Field Librarians Workshop in Washington, DC.
- November 24- December 1 - Rob Bistodeau traveled to San Jose, California, for Molecular training and education.

- Frances Tonsich traveled to Honolulu, Hawaii, to provide secretarial services at Fate and Impact of Marine Debris Workshop.
- November 25-29 - Izadore Barrett attended the Fate and Impact of Marine Debris Workshop in Honolulu, Hawaii.
- November 25-December 5 - William Perrin traveled to Honolulu, Hawaii, to attend the Fate and Impact of Marine Debris Workshop and to meet with SWFC staff to plan research on dolphin distribution and variation.
- November 26-29 - Dan Huppert participated in a meeting of the Pacific Fishery Management Council's Scientific and Statistical Committee and delivered a lecture on Implementation of Fisheries Economics in Southwest Fisheries to the University of Washington's School of Fisheries' 1984 Seminar Series in Fisheries Economics in Seattle, Washington.
- 27-29 - Michael Laurs went to Las Vegas, Nevada, to make a presentation at the American Fisherman's Research Foundation and Western Fishboat Owners Association meetings.
- 28 - Alec MacCall and Richard Methot consulted with Richard Klingbeil and Eugene Fleming of the California Department of Fish and Game regarding the scientific basis of Pacific mackerel management options.

Pacific Environmental Group

- November 5-7 - Dick Parrish and Andy Bakun traveled to SWFC La Jolla, California, where they were invited participants in the Sardine Anchovy Recruitment Project meeting.
- 7-9 - Rosemary Troian traveled to Seattle, Washington, to attend the WASC customer workshop.

Tiburon Laboratory

- November 12-15 - Norman Abramson attended a fishery management meeting in Anchorage, Alaska.
- 19 - Ed Ueber met in Berkeley, California, with Sea Grant and California Department of Fish and Game personnel to discuss how to contact gill-net fishermen.
- 23 - Ed Ueber met with processors, consultants and California Department of Fish and Game staff in Sacramento, California.

- 26-29 - Norman Abramson attended the PMC and PMFC meetings in Seattle, Washington.
- 26-30 - William Lenarz traveled to Hawaii to give a presentation on "Theoretical proximations of densities of trawl webbing at sea based on mortalities of fur seals" at the Conference on the Fate and Impact of Marine Debris, sponsored by the SWFC Honolulu Laboratory.
- 28 - Ed Ueber met with gill-net fishermen in Half Moon Bay, and also attended a workshop given by J. Bordynoski on fishermen's finances.

Personnel

Honolulu Laboratory

- November 1 - Alan K.H. Kam, Biological Technician (Wildlife) - Extension of Temporary Appointment.
- 4 - Raymond P. Clarke, Biological Aid (Fisheries) - Full-Time Temporary Appointment.
- 5 - Mark A. Crossler - Entered on Duty as a Student Volunteer.
- 9 - Charles K. Pribyl - Computer Programmer - Part-Time Temporary Appointment.
- 25 - Wesley K. Higuchi, Mathematics Aid - Conversion to Temporary Appointment.

La Jolla Laboratory

- November 6 - Debra Snow, Biological Aid - Entered on Duty.
- 20 - James Ryan, Biological Technician - Entered on Duty.
- 24 - Eugene Sibbald, Computer Systems Analyst - Resignation.
- 27 - Fred Ackroyd, Computer Aid - Entered on Duty.

Tiburon Laboratory

- November 25 - Daniel F. Howard, Biological Technician - Conversion to Career-Conditional.

TrainingTiburon Laboratory

November 26-30 - Nancy Wiley, Computer Programmer Analyst - Molecular Systems and Installation, Molecular Computer, San Jose, California.

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